National Institute of Environmental Health Sciences

Predicting the vulnerability of reservoirs to poor water quality and cyanobacterial blooms

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Abstract:

Cyanobacterial blooms in drinking water reservoirs present a major ecosystem functioning and human health issue. The ability to predict reservoir vulnerability to these blooms would provide information critical for decision making, hazard prevention and management. We developed a new, comparative index of vulnerability based on simple measures of reservoir and catchment characteristics, rather than water quality data, which were instead used to test the index's effectiveness. Testing was based on water quality data collected over a number of seasons and years from 15 drinking water reservoirs in subtropical, southeast Queensland. The index correlated significantly and strongly with algal cell densities, including potentially toxic cyanobacteria, as well as with the proportions of cyanobacteria in summer months. The index also performed better than each of the measures of reservoir and catchment characteristics alone, and as such, was able to encapsulate the physical characteristics of subtropical reservoirs, and their catchments, into an effective indicator of the vulnerability to summer blooms. This was further demonstrated by calculating the index for a new reservoir to be built within the study region. Under planned dimensions and land use, a comparatively high level of vulnerability was reached within a few years. However, the index score and the number of years taken to reach a similar level of vulnerability could be reduced simply by decreasing the percentage of grazing land cover via revegetation within the catchment. With climate change, continued river impoundment and the growing demand for potable water, our index has potential decision making benefits when planning future reservoirs to reduce their vulnerability to cyanobacterial blooms.

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Resource Description

Communication: ☑

resource focus on research or methods on how to communicate or frame issues on climate change; surveys of attitudes, knowledge, beliefs about climate change

A focus of content

Communication Audience: ☑

audience to whom the resource is directed

Policymaker

Early Warning System: ☑

resource focus on systems used to warn populations of high temperatures, extreme weather, or other elements of climate change to prevent harm to health

A focus of content

Exposure : ☑

weather or climate related pathway by which climate change affects health

Ecosystem Changes, Food/Water Quality

Food/Water Quality: Biotoxin/Algal Bloom

Geographic Feature: ☑

resource focuses on specific type of geography

Freshwater, Other Geographical Feature

Other Geographical Feature : Subtropical

Geographic Location: ☑

resource focuses on specific location

Non-United States

Non-United States: Australasia

Health Impact: ☑

specification of health effect or disease related to climate change exposure

Other Health Impact

Other Health Impact: Cyanobacteria toxin poisoning

Intervention: ☑

strategy to prepare for or reduce the impact of climate change on health

A focus of content

Mitigation/Adaptation: ☑

mitigation or adaptation strategy is a focus of resource

Adaptation

Model/Methodology: ☑

type of model used or methodology development is a focus of resource

Exposure Change Prediction

Resource Type: ☑

format or standard characteristic of resource

Research Article

Timescale: ☑

time period studied

Time Scale Unspecified

Vulnerability/Impact Assessment:

resource focus on process of identifying, quantifying, and prioritizing vulnerabilities in a system

A focus of content